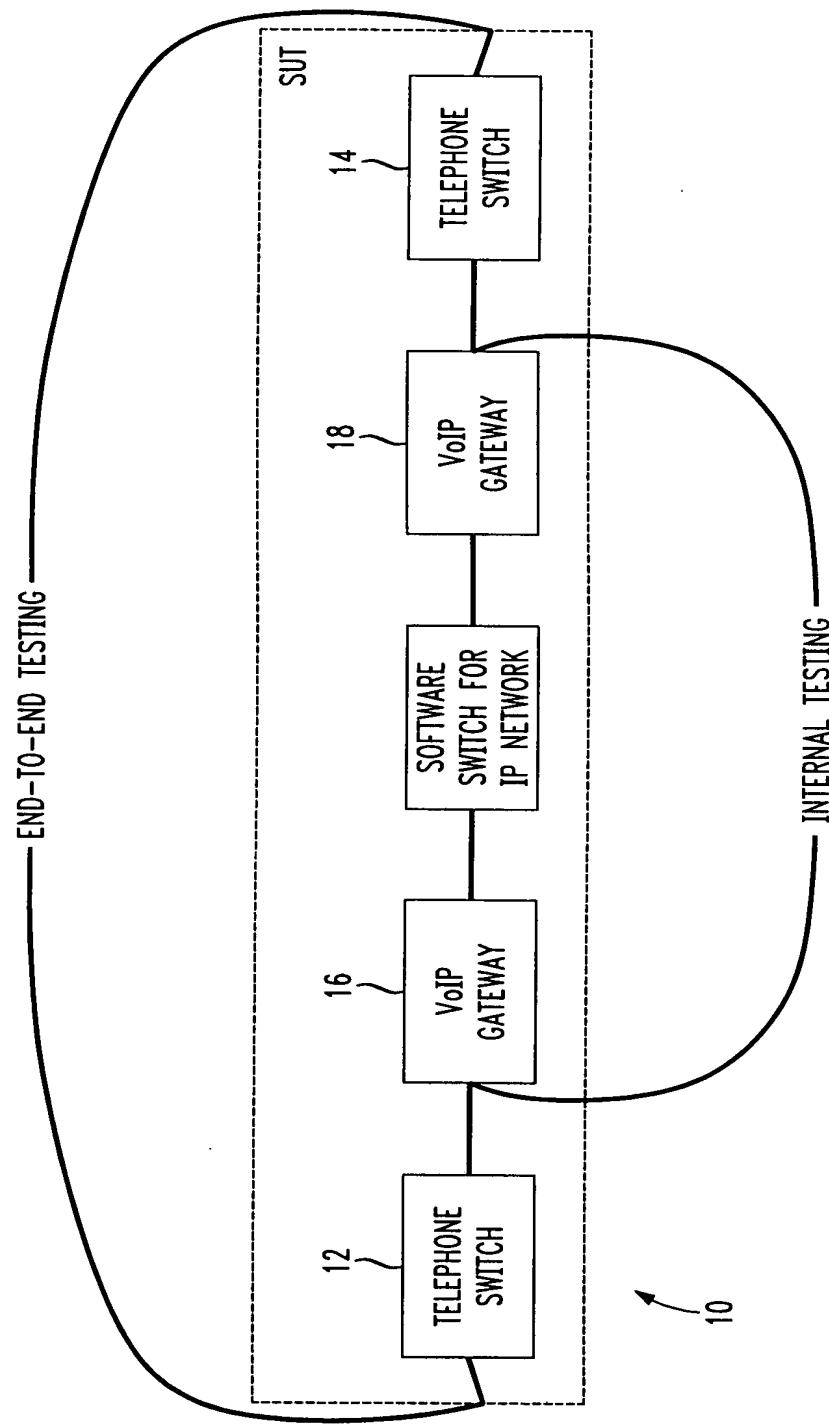


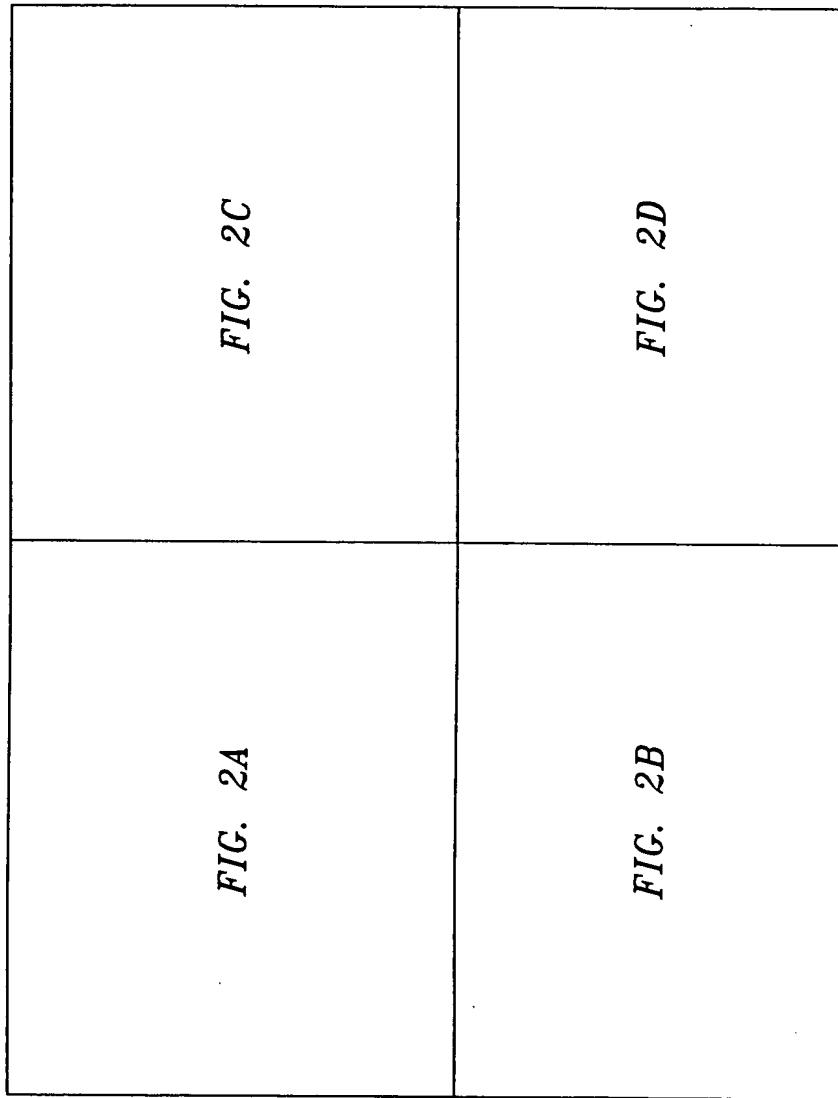
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FIG. 1

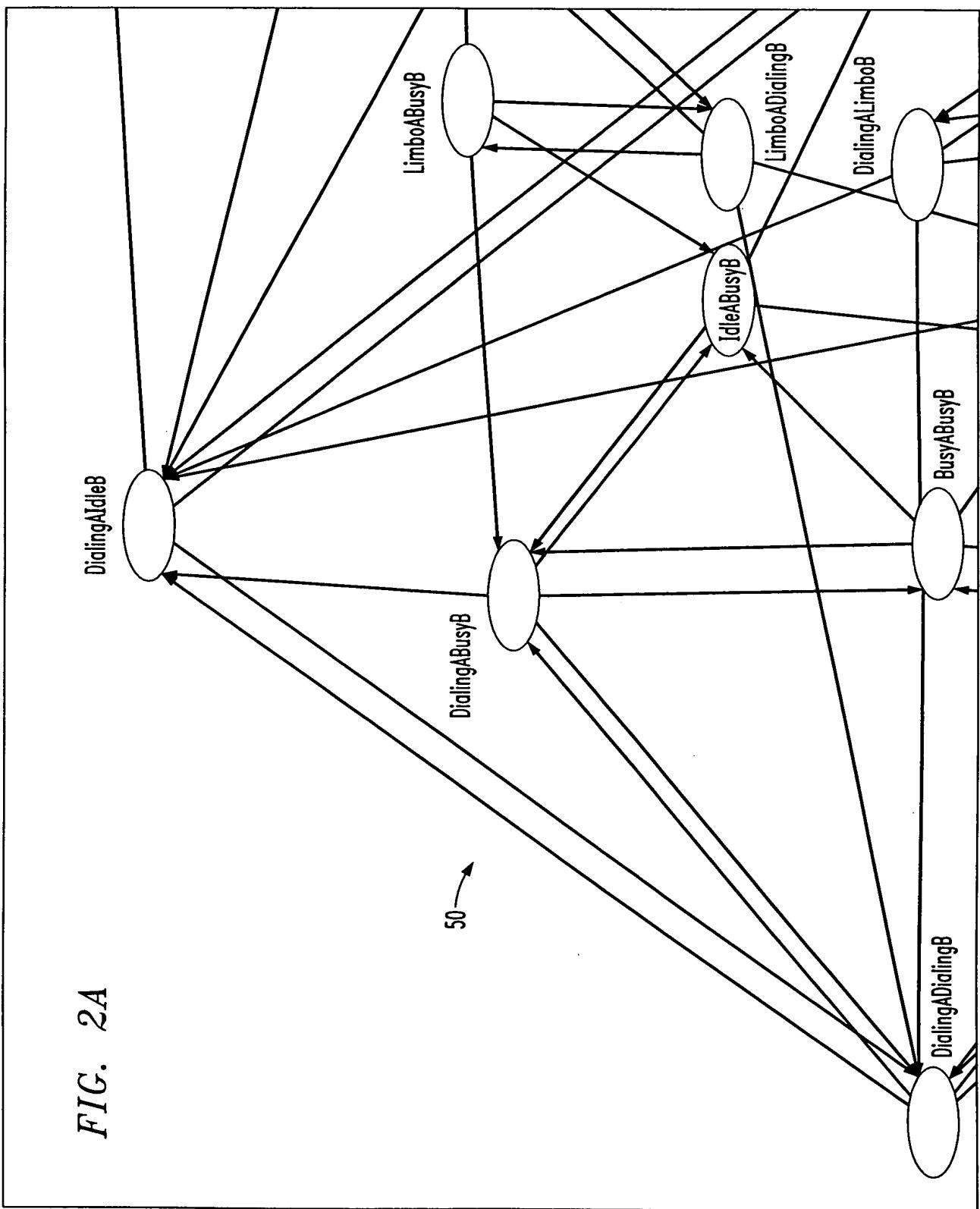


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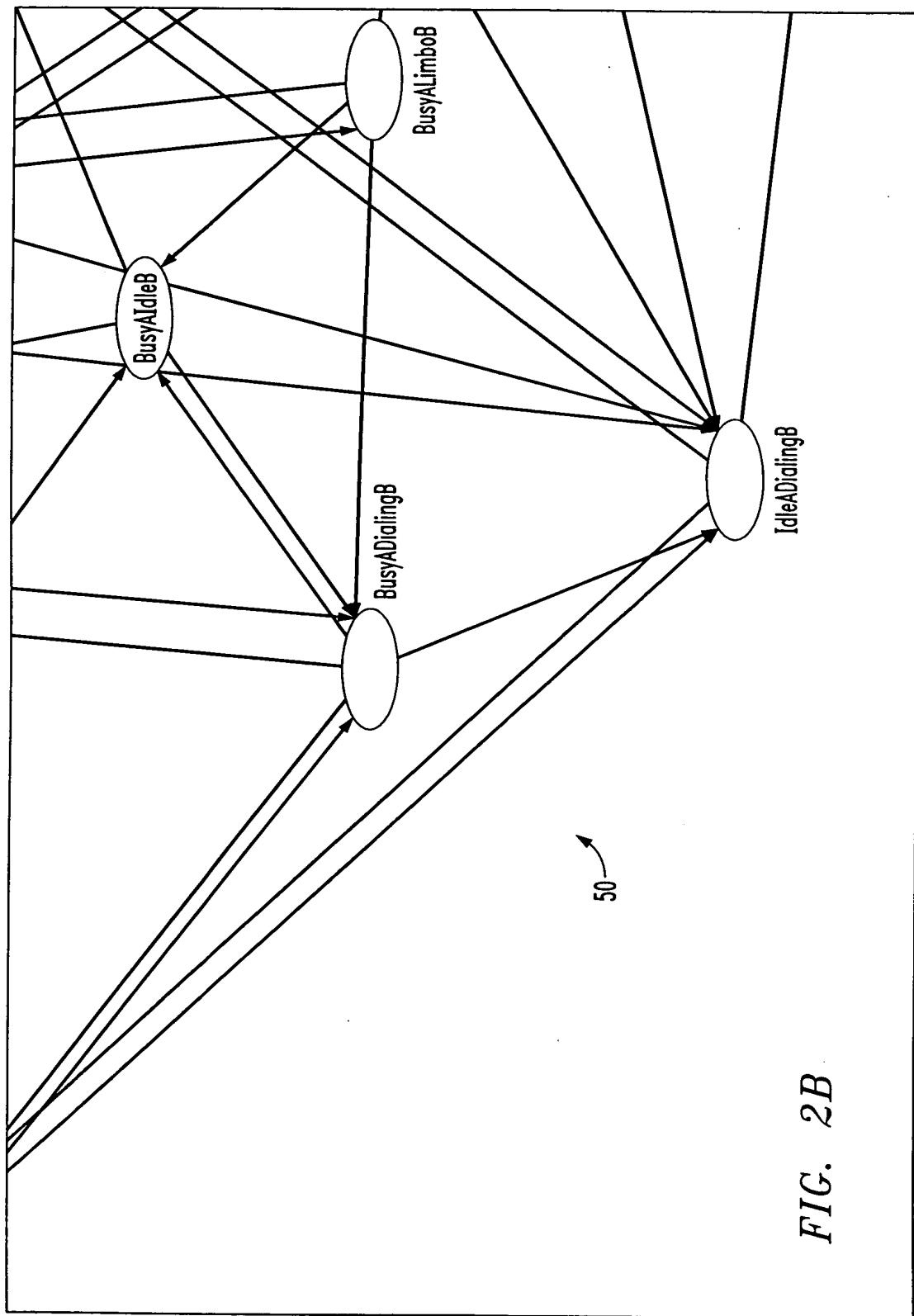
FIG. 2



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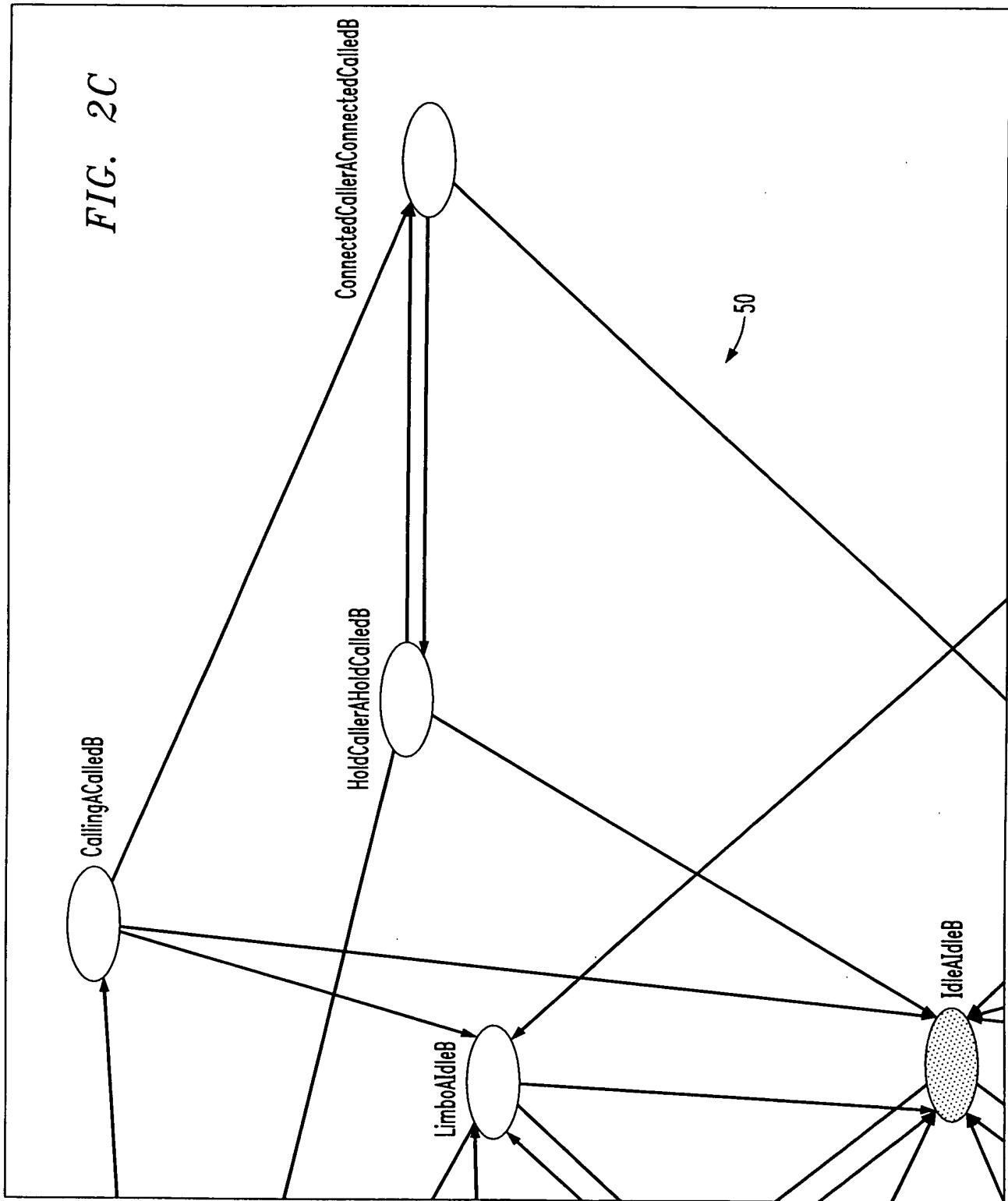


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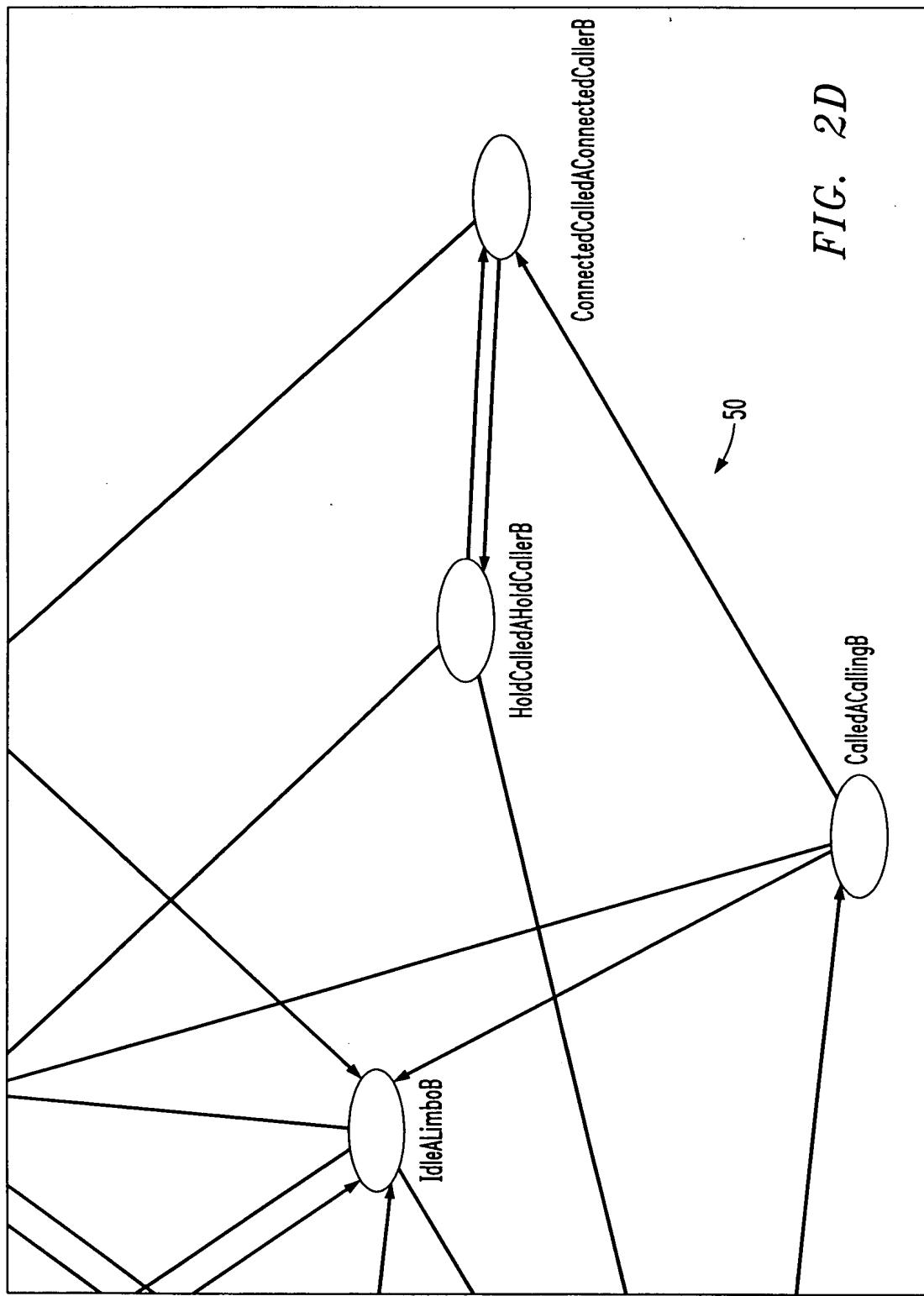
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FIG. 2C



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FIG. 2D



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FIG. 3

```

gui fsm
states { 21
1. CallingACalledB
2. DialingADialingB
3. IdleABusyB
4. CalledACallingB
5. BusyABusyB
6. DialingALimboB
7. BusyADialingB
8. BusyAIdleB
9. BusyALimboB
10. LimboADialingB
11. ConnectedCalledAConnectedCallerB
12. LimboABusyB
13. IdleADialingB
14. LimboAIdleB
15. DialingABusyB
16. HoldCalledAHoldCallerB
17. HoldCallerAHoldCalledB
18. DialingAIdleB
19. IdleALimboB
20. ConnectedCallerAConnectedCalledB
21. IdleAIdleB
}

start {
IdleAIdleB

boolean term=false;
boolean IdleA=true;
boolean IdleB=true;
boolean DialingA=false;
boolean DialingB=false;

}

transitions { 68
1. BusyADialingB BusyAIdleB {
    i { {On-hook B} }
    o { {} }
    p { true }
    a { { DialingB=false; IdleB=true } }
}
2. IdleADialingB DialingADialingB {
    i { {Off-hook A} }
    o { {DialTone A} }
    p { true }
    a { {IdleA=false; DialingA=true} }
}
3. BusyADialingB IdleADialingB {
    i { {On-hook A} }
    o { {} }
    p { true }
    a { { IdleA=true } }
}
4. IdleABusyB IdleAIdleB {
    i { {On-hook B} }
    o { {} }
    p { true }
    a { {term=true;IdleB=true} }
}

i = input
o = output
p = predicate
a = action

```

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FIG. 4

```

}
5. HoldCallerAHoldCalledB IdleAIdleB {
    i { {On-hook A} }
    o { {} }
    p { true }
    a { {term=true;IdleA=true;IdleB=true} }
}

6. IdleALimboB IdleADialingB {
    i { {Timeout B} }
    o { {DialTone B} }
    p { true }
    a { { DialingB=true } }
}

7. BusyADialingB BusyABusyB {
    i { {Dial B A} }
    o { {LineBusyTone B} }
    p { true }
    a { { DialingB=false } }
}

8. HoldCalledAHoldCallerB IdleAIdleB {
    i { {On-hook B} }
    o { {} }
    p { true }
    a { {term=true;IdleB=true;IdleA=true} }
}

9. DialingAIdleB DialingADialingB {
    i { {Off-hook B} }
    o { {DialTone B} }
    p { true }
    a { { IdleB=false; DialingB=true } }
}

10. IdleADialingB IdleAIdleB {
    i { {On-hook B} }
    o { {} }
    p { true }
    a { {term=true;IdleB=true;DialingB=false} }
}

11. BusyABusyB BusyAIdleB {
    i { {On-hook B} }
    o { {} }
    p { true }
    a { { IdleB=true } }
}

12. DialingADialingB BusyADialingB {
    i { {Dial A B} }
    o { {LineBusyTone A} }
    p { true }
    a { { DialingA=false } }
}

13. IdleAIdleB IdleADialingB {
    i { {Off-hook B} }
    o { {DialTone B} }
    p { !term }
    a { {IdleB=false; DialingB=true} }
}

14. HoldCalledAHoldCallerB IdleADialingB {
    i { {Timeout AB} }
    o { {DialToneB} }
    p { true }
    a { { IdleA=true; DialingB=true } }
}

15. IdleABusyB DialingABusyB {
    i { {Off-hook A} }
    o { {DialTone A} }
    p { true }
    a { { IdleA=false; DialingA=true } }
}

16. CallingACalledB ConnectedCallerAConnectedCalledB {
    i { {Off-hook B} }
    o { {} }
    p { true }
    a { {} }
}

```

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FIG. 5

```

}
17. DialingADialingB DialingABusyB {
    i { {Dial B A} }
    o { {LineBusyTone B} }
    p { true }
    a { { DialingB=false } }
}

18. CalledACallingB IdleALimboB {
    i { {Timeout AB} }
    o { {} }
    p { true }
    a { { IdleA=true } }
}

19. ConnectedCallerAConnectedCalledB IdleALimboB {
    i { {On-hook A} }
    o { {} }
    p { true }
    a { { IdleA=true } }
}

20. ConnectedCallerAConnectedCalledB HoldCallerAHoldCalledB {
    i { {On-hook B} }
    o { {} }
    p { true }
    a { {} }
}

21. IdleAIdleB DialingAIdleB {
    i { {Off-hook A} }
    o { {DialTone A} }
    p { !term }
    a { {IdleA=false; DialingA=true} }
}

22. DialingABusyB BusyABusyB {
    i { {Dial A B} }
    o { {LineBusyTone A} }
    p { true }
    a { { DialingA=false } }
}

23. IdleALimboB IdleAIdleB {
    i { {On-hook B} }
    o { {} }
    p { true }
    a { {term=true;IdleB=true} }
}

24. LimboAIdleB IdleAIdleB {
    i { {On-hook A} }
    o { {} }
    p { true }
    a { {term=true;IdleA=true} }
}

25. HoldCalledAHoldCallerB ConnectedCalledAConnectedCallerB {
    i { {Off-hook A} }
    o { {} }
    p { true }
    a { {} }
}

```

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FIG. 6

```

}
26. DialingABusyB IdleABusyB {
    i { {On-hook A} }
    o { {} }
    p { true }
    a { { DialingA=false; IdleA=true } }
}

27. DialingABusyB DialingAIdleB {
    i { {On-hook B} }
    o { {} }
    p { true }
    a { { IdleB=true } }
}

28. HoldCallerAHoldCalledB DialingAIdleB {
    i { {Timeout AB} }
    o { {DialTone A} }
    p { true }
    a { { DialingA=true; IdleB=true } }
}

29. DialingAIdleB CallingACalledB {
    i { {Dial A B} }
    o { {AudibleRinging A,Ringing B} }
    p { true }
    a { { DialingA=false; IdleB=false } }
}

30. IdleADialingB CalledACallingB {
    i { {Dial B A} }
    o { {AudibleRinging B,Ringing A} }
    p { true }
    a { { IdleA=false; DialingB=false } }
}

31. BusyABusyB IdleABusyB {
    i { {On-hook A} }
    o { {} }
    p { true }
    a { { IdleA=true } }
}

32. CalledACallingB IdleAIdleB {
    i { {On-hook B} }
    o { {} }
    p { true }
    a { { term=true;IdleA=true;IdleB=true } }
}

33. ConnectedCalledAConnectedCallerB HoldCalledAHoldCallerB {
    i { {On-hook A} }
    o { {} }
    p { true }
    a { {} }
}

34. BusyAIdleB BusyADialingB {
    i { {Off-hook B} }
    o { {DialTone B} }
    p { true }
    a { { IdleB=false; DialingB=true } }
}

35. LimboAIdleB DialingAIdleB {
    i { {Timeout A} }
    o { {DialToneA} }
    p { true }
    a { { DialingA = true; } }
}

36. IdleALimboB DialingALimboB {
    i { {Off-hook A} }
    o { {DialTone A} }
    p { true }
    a { { IdleA=false;DialingA=true} }
}

37. LimboAIdleB LimboADialingB {
    i { {Off-hook B} }
    o { {DialTone B} }
    p { true }
    a { { IdleB=false;DialingB=true} }
}

```

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FIG. 7

```

}
38. DialingALimboB IdleALimboB {
    i { {On-hook A} }
    o { {} }
    p { true }
    a { {IdleA=true;DialingA=false} }
}

39. BusyALimboB IdleALimboB {
    i { {On-hook A} }
    o { {} }
    p { true }
    a { {IdleA=true} }
}

40. LimboABusyB IdleABusyB {
    i { {On-hook A} }
    o { {} }
    p { true }
    a { {IdleA=true} }
}

41. LimboADialingB IdleADialingB {
    i { {On-hook A} }
    o { {} }
    p { true }
    a { {IdleA=true} }
}

42. DialingALimboB DialingAIdleB {
    i { {On-hook B} }
    o { {} }
    p { true }
    a { {IdleB=true} }
}

43. DialingAIdleB IdleAIdleB {
    i { {On-hook A} }
    o { {} }
    p { true }
    a { {term=true;IdleA=true;DialingA=false} }
}

44. BusyALimboB BusyAIdleB {
    i { {On-hook B} }
    o { {} }
    p { true }
    a { {IdleB=true} }
}

45. BusyAIdleB IdleAIdleB {
    i { {On-hook A} }
    o { {} }
    p { true }
    a { {term=true;IdleA=true} }
}

46. LimboADialingB LimboAIdleB {
    i { {On-hook B} }
    o { {} }
    p { true }
    a { {DialingB=false;IdleB=true} }
}

47. LimboABusyB LimboAIdleB {
    i { {On-hook B} }
    o { {} }
    p { true }
    a { {IdleB=true} }
}

48. CalledACallingB ConnectedCalledAConnectedCallerB {
    i { {Off-hook A} }
    o { {} }
    p { true }
    a { {} }
}

49. DialingALimboB BusyALimboB {
    i { {Dial A B} }
    o { {LineBusyTone A} }
    p { true }
    a { {DialingA=false} }
}

```

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FIG. 8

```

}
50. DialingADialingB IdleADialingB {
    i { {On-hook A} }
    o { {} }
    p { true }
    a { {IdleA=true; DialingA=false} }
}

51. LimboADialingB LimboABusyB {
    i { {Dial B A} }
    o { {LineBusyTone B} }
    p { true }
    a { {DialingB=false} }
}

52. CallingACalledB LimboAIdleB {
    i { {Timeout AB} }
    o { {} }
    p { true }
    a { { IdleB=true; } }
}

53. BusyAIdleB DialingAIdleB {
    i { {Timeout A} }
    o { {DialTone A} }
    p { true }
    a { { DialingA=true } }
}

54. DialingADialingB DialingAIdleB {
    i { {On-hook B} }
    o { {} }
    p { true }
    a { { DialingB=false; IdleB=true } }
}

55. BusyADialingB DialingADialingB {
    i { {Timeout A} }
    o { {DialTone A} }
    p { true }
    a { { DialingA=true } }
}

56. ConnectedCalledAConnectedCallerB LimboAIdleB {
    i { {On-hook B} }
    o { {} }
    p { true }
    a { { IdleB=true } }
}

57. BusyALimboB DialingALimboB {
    i { {Timeout A} }
    o { {DialTone A} }
    p { true }
    a { { DialingA=true } }
}

58. HoldCallerAHoldCalledB ConnectedCallerAConnectedCalledB {
    i { {Off-hook B} }
    o { {} }
    p { true }
    a { {} }
}

59. BusyABusyB DialingABusyB {
    i { {Timeout A} }
    o { {DialTone A} }
    p { true }
    a { { DialingA=true } }
}

60. CallingACalledB IdleAIdleB {
    i { {Onhook A} }
    o { {} }
    p { true }
    a { {term=true;IdleA=true;IdleB=true} }
}

61. LimboADialingB DialingADialingB {
    i { {Timeout A} }
    o { {DialTone A} }
    p { true }
    a { { DialingA=true } }
}

```

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FIG. 9

```

}
62. LimboABusyB DialingABusyB {
    i { {Timeout A} }
    o { {DialTone A} }
    p { true }
    a { DialingA=true }
}

63. IdleABusyB IdleADialingB {
    i { {Timeout B} }
    o { {DialTone B} }
    p { true }
    a { DialingB=true }
}

64. DialingABusyB DialingADialingB {
    i { {Timeout B} }
    o { {DialTone B} }
    p { true }
    a { DialingB=true }
}

65. DialingALimboB DialingADialingB {
    i { {Timeout B} }
    o { {DialTone B} }
    p { true }
    a { DialingB=true }
}

66. BusyABusyB BusyADialingB {
    i { {Timeout B} }
    o { {DialTone B} }
    p { true }
    a { DialingB=true }
}

67. BusyALimboB BusyADialingB {
    i { {Timeout B} }
    o { {DialTone B} }
    p { true }
    a { DialingB=true }
}

68. LimboABusyB LimboADialingB {
    i { {Timeout B} }
    o { {DialTone B} }
    p { true }
    a { DialingB=true }
}

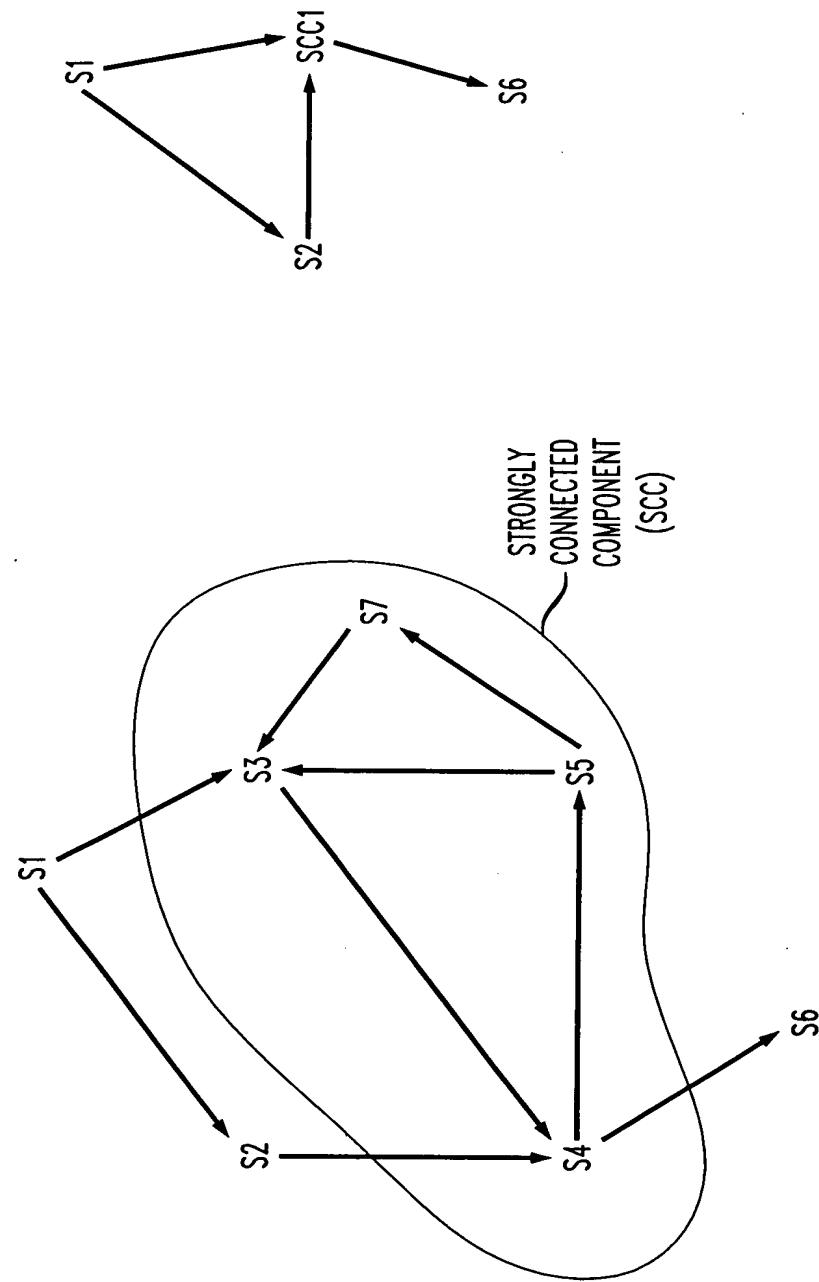
```

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FIG. 10

1 GENERATE ALL ACYCLIC PATHS

1a. COLLAPSE STRONGLY CONNECTED COMPONENTS INTO A SINGLE NODE

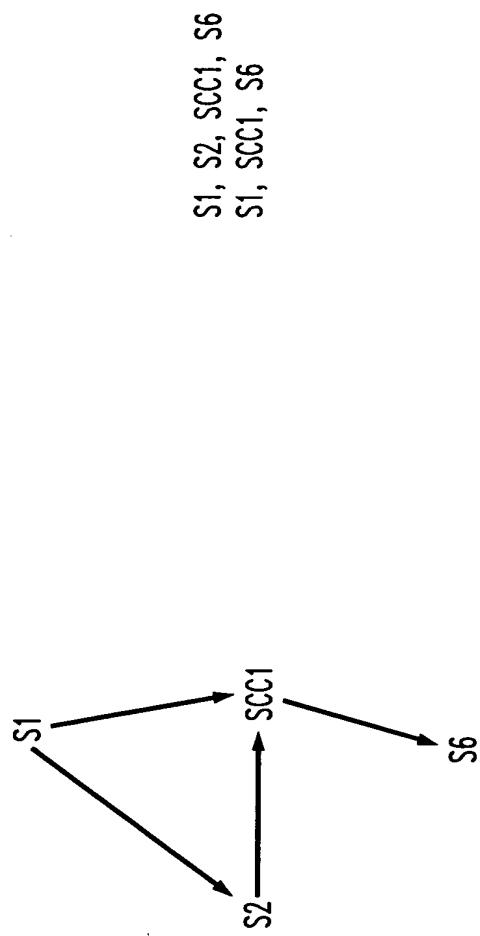


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FIG. 11

1 GENERATE ALL ACYCLIC PATHS

1b DETERMINE ALL PATHS IN DAG:

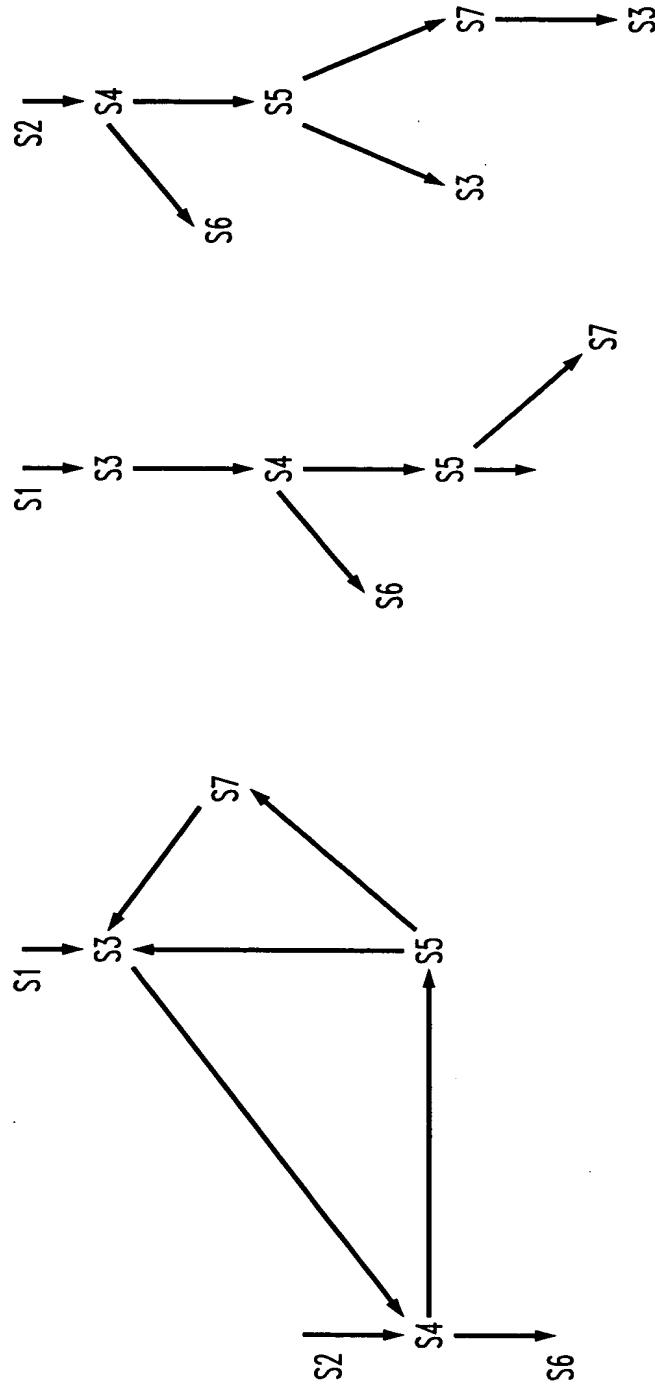


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FIG. 12

1 GENERATE ALL ACYCLIC PATHS

1c BUILD NEXT-TRANSITION TREE FOR SCC:

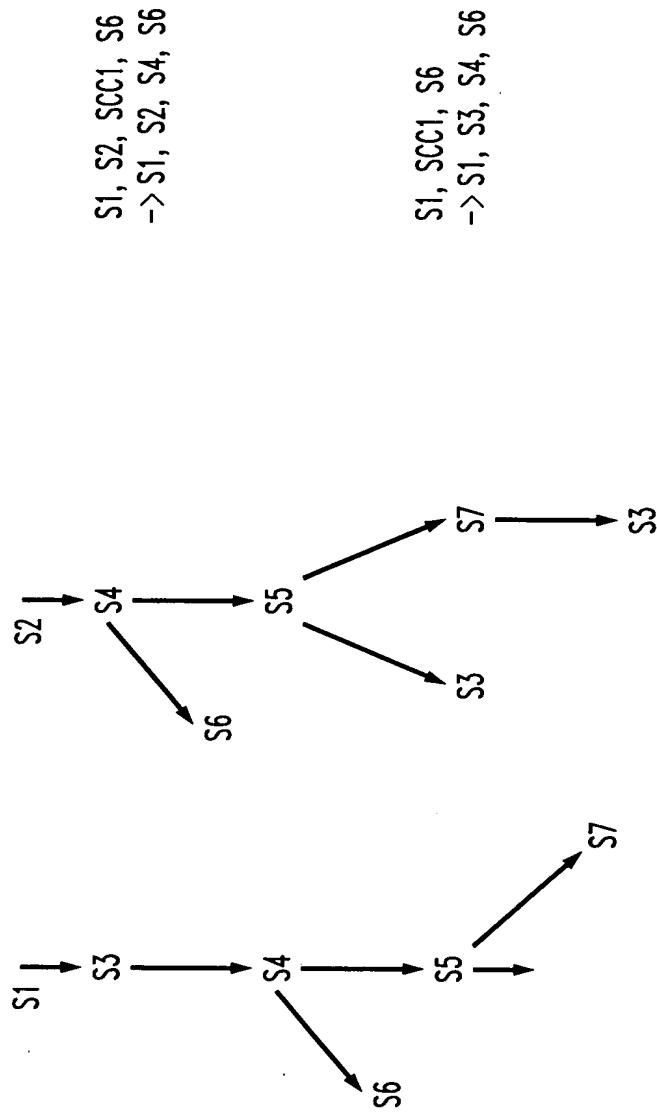


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FIG. 13

1 GENERATE ALL ACYCLIC PATHS

1d EXPAND EACH SCC WITH ALL PATHS THROUGH NEXT-TRANSITION TREE

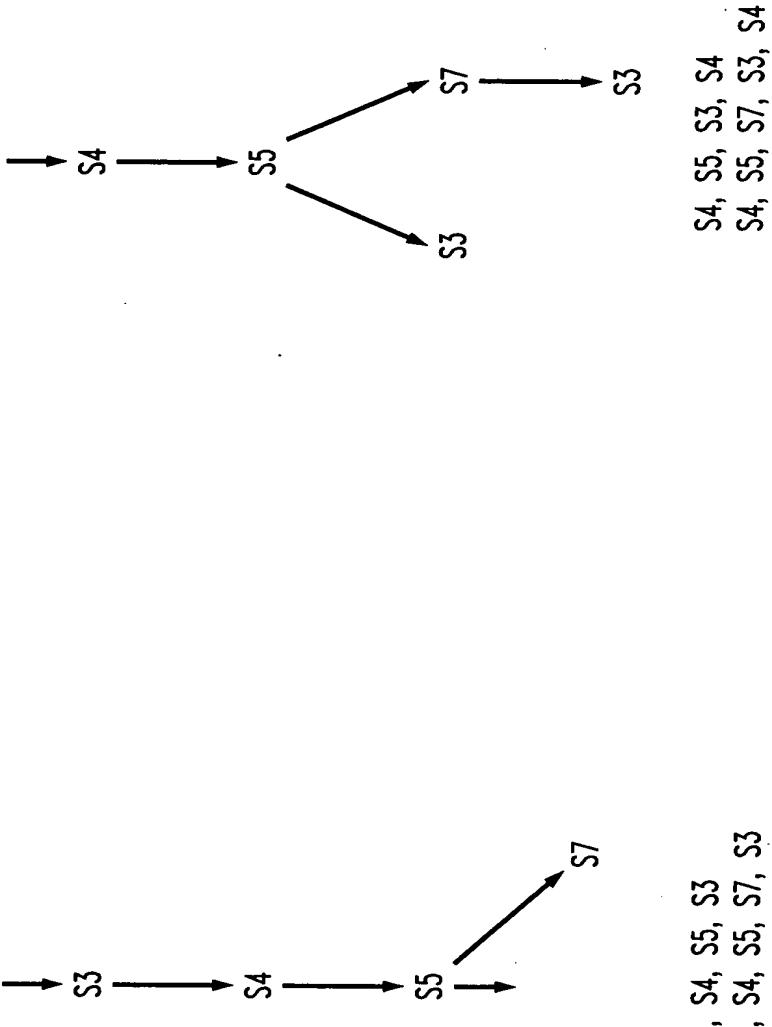


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FIG. 14

2 GENERATE ALL SIMPLE CYCLES

RE-USE NEXT-TRANSITION TREE



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FIG. 15

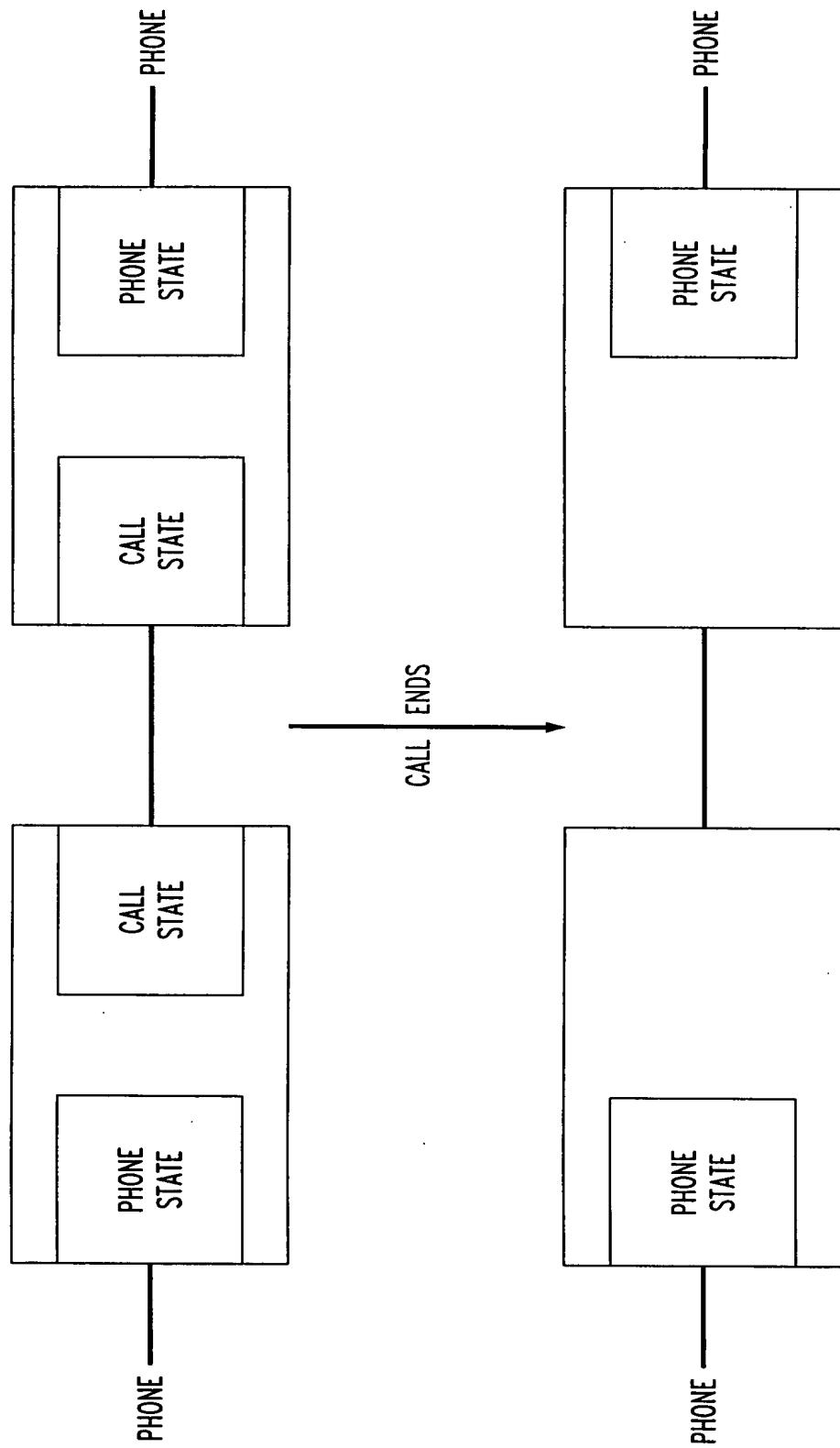
3 COMBINE THE PATHS AND THE CYCLES

$$\begin{array}{c} S_1, S_2, S_4, S_6 \\ + \\ S_1, S_3, S_4, S_6 \end{array} \quad + \quad \begin{array}{c} S_3, S_4, S_5, S_3 \\ S_3, S_4, S_5, S_7, S_3 \end{array}$$
$$= \quad \begin{array}{c} S_1, S_2, S_4, S_5, S_3, S_4, S_6 \\ S_1, S_2, S_4, S_5, S_7, S_3, S_4, S_6 \\ S_1, S_3, S_4, S_5, S_3, S_4, S_6 \\ S_1, S_3, S_4, S_5, S_7, S_3, S_4, S_6 \end{array}$$

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CRITERIA FOR ADEQUATE COVERAGE

FIG. 16



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FIG. 17

